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## Terrestrial Crustaceans from Shiga Prefecture, central Japan\*

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### 滋賀県の陸生甲殻類

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従来、滋賀県においては等脚目を初めとする大型陸産甲殻類は志賀町における生態学的研究 (Watanabe, 1991) 等の調べられていなかった。この度、滋賀県生きものの総合調査委員会からの依頼で、土壌動物相の調査が京大名誉教授渡辺弘之氏を中心に行われ、その一環として筆者が陸産甲殻類を担当し、2009年7月に第1回調査が行われた。今回の主要調査対象地域は多賀町河内の河内風穴、東近江市永源寺町神津畑、甲賀市土山町前野瀧樹神社、高島市マキノ西浜湿原の4ヶ所であったが、同調査で高島市海津大崎、余呉町川並等についても調査した。筆者は 同年10月に単独で高島市今津町北仰今津浜および市北生見、大津市北比良および今堅田、草津市下物町烏丸半島、近江八幡市長命寺山麓および小田が浜、安土町安土山麓、彦根市荒神山麓、長浜市早崎町、木之本町山梨子、西浅井町沓掛などを調査した。また、他にメンバーの渡辺弘之氏、江波義成氏、南谷幸男氏、佐藤英文氏採集の標本も調査した。更に西川喜朗氏、渡辺弘之氏、野村周平氏ら採集の富山市科学博物館所蔵の滋賀県産標本を調査した。調査の結果、滋賀県のから12種の等脚類、1種の端脚類の1種のカニ類を確認した。そのうち、等脚類の2種を新種として記載した。1種目は *Mongoloniscus oumiensis* [和名：オウミサトワラジムシ] として記載したもので、南九州にから知られている *Mongoloniscus satsumaensis* と類似するが (1) 第2-4胸部体節の剛毛が体縁からより遠い位置にあること、(2) 第1小顎外葉のすべての歯に切れ込みが無いこと、(3) 雄第2腹肢内肢が短いこと、(4) 生殖突起先端が尖っていることより区別される。2種目は *Agnara biwakoensis* [和名：ココクヒナワラジムシ] として記載されたもので、石川県羽咋市から記録されている *Agnara pannosus* と類似するが、(1) 雄第1腹肢外肢外縁に凹凸が無いこと、(2) 第1触角の感覚剛毛数が多いこと、(3) 第1小顎外葉に鋸歯があること、(4) 第1小顎内葉に小さな突起があること、(5) 雄第2腹肢外肢外縁のとげの数が多くことで区別される。

2種の新種のホロタイプは富山市科学博物館に、パラタイプは滋賀県立琵琶湖博物館、大阪市立自然史博物館、北九州市立歴史・自然史博物館ならびに国立科学博物館に保管される。

キーワード：等脚類, 新種, 滋賀県, 分類学, オウミサトワラジムシ, ココクヒナワラジムシ

Key words: Isopod, new species, Shiga, taxonomy, *Mongoloniscus oumiensis*, *Agnara biwakoensis*

\*Contributions from the Toyama Science Museum, No.383

Hitherto, the knowledge of terrestrial isopodan fauna in Japan was much ignored, except only Watanabe's ecological work (Watanabe, 1991). I have never carried out the faunal survey in Shiga-Prefecture; because not expecting of occurrence of seashore-dwelling species. Therefore, only little specimens have been examined in this prefecture. But recently, in order to proceed the knowledge on the endangered species, extinct and threatened species, Mr. Keisuke Kobayashi and Dr. Hiroyuki Watanabe to examine the soil fauna of Shiga Prefecture, and I made a survey with Drs. Hiroyuki Watanabe, Yoshinari Enami and Yukio Minamiya.

The main surveys were carried out twice in 2009. The first one was carried out with three scientists on July 4-5, 2009. The main areas are as follows: Nishihama, Makino, Takashima-shi, Kaizu-osaki, Takashima-shi; Kawanami, Yogo-cho; Shore of Yogo-Ko, Kinomoto-cho; Kawachi wind-vent, Kawachi, Taga-cho; Kozubata, Eigenji, Higashi-oumi-shi; Tagi-jinja, Maeno, Tsuchiyama-machi, Kouka-shi.

Adding this, I carried out the second survey on Oct. 4-6, 2009. The main areas are as follows: Imazuhamamachi, Imazumachi, Kitoge, Takasima-shi; Kitanamami, Imazumachi, Takasima-shi; Tochu-dani, Imazu-machi, Takasima-shi; Foot of Mt. Nishiyama, Kutsuki, Takasima-shi; Indani, Kitahira, Otsu-shi; Imakatata, Otsu-shi; Oroshimo, Kusatsu-shi.; Akanoi, Moriyama-shi; Foot of Choumeiji-san, Choumeiji-cho, Oumihachiman-shi; Foot of Kasahoko-yama, Odagahama, Kishima-cho, Oumihachiman-shi; Foot of Azuchi-yama, Shimotoyoura, Azuchi-cho; Foot of Mt. Kojin-san, Mitsuya-cho, Hikone-shi; Hayazaki-cho, "Okubiwa sports-no mori", Nagahama-shi; Yamanashi, Kinomoto-cho; Kutsukake, Nishiazai-cho.

I could examine the specimens collected from Shiga prefecture at Toyama Science Museum (TSM) which had been collected mainly by Dr. Hiroyuki Watanabe, Dr. Yoshiaki Nishikawa, Dr. Hidebumi Sato and Dr. Shuhei Nomura.

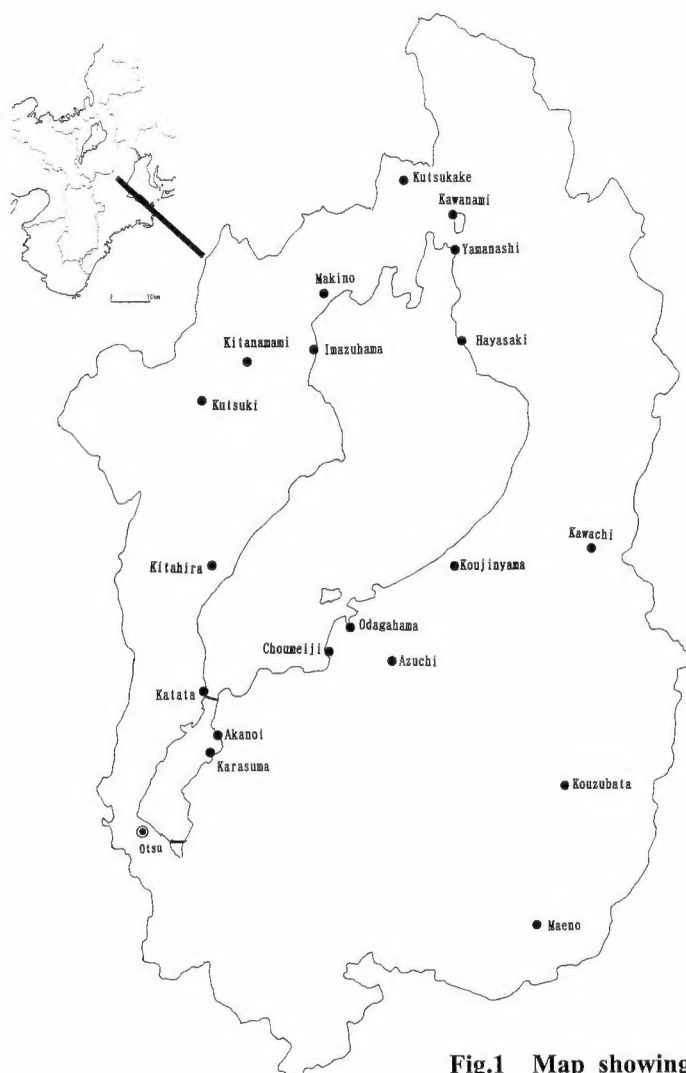


Fig.1 Map showing main sampling sites.

Order Isopoda

Family Ligiidae

***Ligidium (Nipponoligidium) japonicum* Verhoeff, 1918**

(Japanese name: Nihon-hime-funamushi)

*Material examined:* 2♂♂2♀♀, Imazuhama, Imazumachi, Kitoge, Takasima-shi, Oct. 4, 2009, coll. Noboru Nunomura; 2♀♀, Kitanamami, Imazum-achi, Takasima-shi, Oct. 4, 2009, coll. Noboru Nunomura; 1♀, Tochu-dani, Imazu-machi, Takashima-shi, Oct. 4, 2009, coll. Noboru Nunomura; 3♀♀, Kawanami, Yogo-cho, July 4, 2009, coll. Noboru Nunomura; 1♀, Kaizu-osaki, Takashima-shi, uly, 2009, coll. Noboru Nunomura; 2♂♂12♀♀, Kawachi wind-vent, Kawachi, Taga-cho, July 5, 2009, coll. Noboru Nunomura, Hiroyuki Watanabe and Yoshinari Enami; 1♀, Kawachi wind-vent, Kawachi, Taga-cho, Aug. 1, 2009, Hidebumi Sato; 5♀♀, Kozubata, Eigenji, Higashi-oumi shi, July 5, 2009, coll. Noboru Nunomura; 1♂14♀♀, Kouzubata, Eigenji, Higashi-oumi-shi, Aug. 2, 2009, Hidebumi Sato; 2♂♂5♀♀, *Cryptomeria* forest, Tagi-jinja, Maeno, Tsuchiyama-machi, Kouka-shi, July 5, 2009, coll. Noboru Nunomura; 7♂♂14♀♀, laurel forest, Tagi-jinja, Maeno, Tsuchiyama -machi, Kouka-shi, July 5, 2009, coll. Noboru Nunomura and Yoshinari Enami; 6♀♀, Shiratani, beech forest, Aug. 2, 2009, Hidebumi Sato; 1♀, Shiratani, beech forest, Aug. 1, 2009, Hidebumi Sato; 1♂1♀, *Quercus glauca* and *Camellia japonica* forest, Ikishiro-jinja, Kataoka-machi, Kusatsu-shi, Aug. 1, 2009, Hidebumi Sato; 1♀, Katorigo-jinnja, Nishiazai-machi, Aug. 1, 2009, Hidebumi Sato; 2♀♀ Kasahoko-yama, Odagahama, Okishima-cho, Oumihachiman-shi, Oct. 5, 2009, coll. Noboru Nunomura; 3♂♂4♀♀, Foot of Choumeiji-san, Choumeiji-cho, Oumihachiman-shi, Oct. 5, 2009, coll. Noboru Nunomura.

*Secimens at TSM:* 1♂5♀♀ (TOYA Cr-8649~8654), Sotohata-machi, Otsu-shi, 110~130m, coll. Yoshiaki Nishikawa, July 15, 1976 coll. Yoshiaki Nishikawa; 1♂ (TOYA Cr-18637), Kidoguchi, Otsu-shi, May 4, 1980, coll. Yoshiaki Nishikawa; 1♀ (TOYA Cr-18636), Tenmangu, Kitahira, Shiga-cho, 115m, May 4, 1980, coll. Yoshiaki Nishikawa; 4♂♂9♀♀ (TOYA Cr-18623~18635), Juge-jinnja, Minami-hira. Shiga-machi, 115m, May 4, 1980 coll. Yoshiaki Nishikawa; 3♂♂5♀♀ (TOYA Cr-18592~18599), 7 exs (TOYA Cr-2253~2260), Kitahira, Shiga-cho, 115m, May 4, 1980, coll. Yoshiaki Nishikawa; 1ex (TOYA Cr-18648), Ibukiyama, Ibuki-cho, 1300m, coll. Shuhe Nomura, June 5, 1997; 1♂ (TOYA Cr-18655) Ibukiyama, Ibuki-cho, 350m, coll. Shuhe Nomura, June 5, 1997; 1♀ (TOYA Cr-18656), Samegaidani, Maehara-cho, 200m, coll. Shuhe Nomura, June 5, 1997.

Family Trichoniscidae

***Haplophthalmus danicus* Budde-Lund, 1885**

(Japanese name:Naga-warajimushi)

*Material examined:* 2♀♀, Kaizu-osaki, Takashima-shi, July 4, 2009, coll. Noboru Nunomura; 5♂♂19♀♀, Kawanami, Yogo-cho, July 4, 2009, coll. Noboru Nunomura; 5♀♀, Kawachi wind-vent, Kawachi, Taga-cho, July 5, 2009, coll. Noboru Nunomura and Yoshinari Enami; 5♀♀, Kawachi wind-vent, Kawachi, Taga-cho, Aug. 1, 2009, Hidebumi Sato; 2♂♂4♀♀, Kozubata, Eigenji, Higashi-oumi-shi, July 5, 2009, coll. Noboru Nunomura and Yoshinari Enami; 2♀♀, Tagi-jinja Maeno, Tsuchiyama-machi, Kouka-shi, July 5, 2009, coll. Noboru Nunomura; 7♀♀, Foot of Mt. Kojin-san, Mitsuya-cho, Hikone-shi, Oct. 5, 2009, coll. Noboru Nunomura; 4♂♂5♀♀, Oroshimo, Kusatsu-shi, Oct. 5, 2009, coll. Noboru Nunomura.

*Specimens at TSM:* 1♀ (TOYA Cr-18657), Samegai-dani, Maihara-cho, 200m, June 5, 1997, coll. Shuhe Nomura.

Family Philosciidae

***Burmoniscus japonicus* (Nunomura, 1986)**

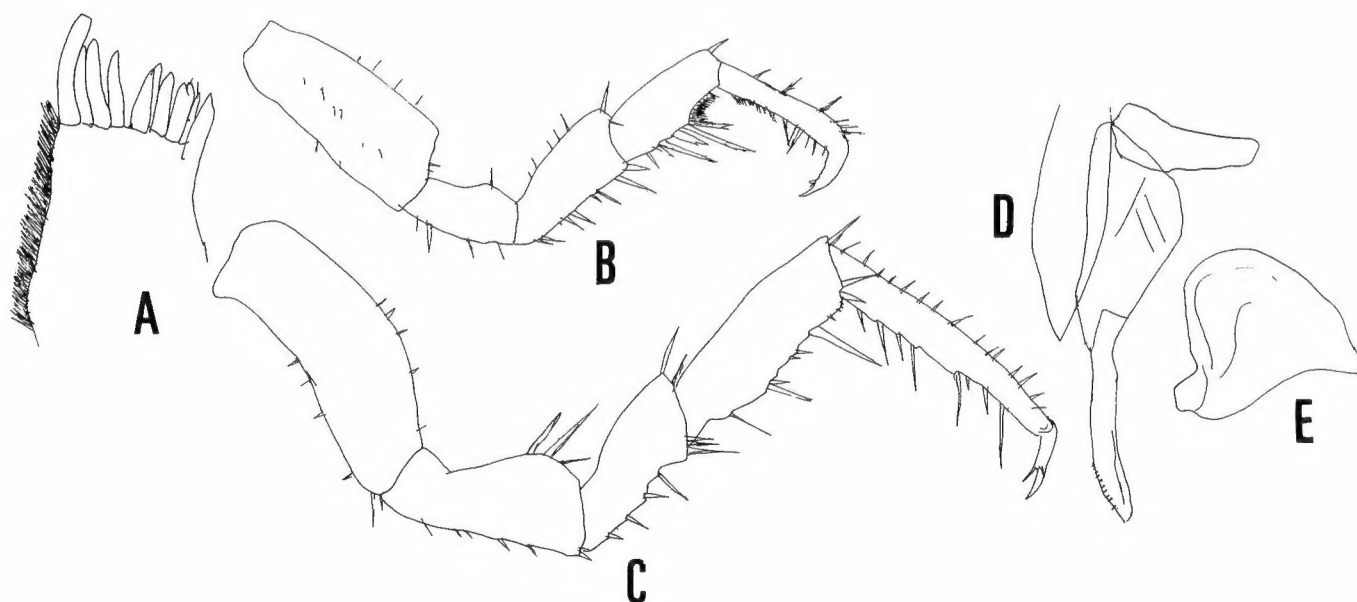
(Japanese name; Yamato-moriwarajimushi)

(Fig. 2)

*Material examined:* 5♂♂19♀♀, Oroshimo, Kusatsu-shi, Oct. 52009, coll. Noboru Nunomura.

*Remarks:* The specimens collected from Oroshimo, Kusatsu, agree with the original description whose type locality is Kainan, Wakayama(Nunomura, 1984), especially, in the shape of male pleopods 1-2(Fig.2D and E) But the former

is different from the latter in the following features: (1)more setae on pereopods(Fig.2B-C), (2)rectangular endite of maxilliped (Fig.2). Taiti,S.,& Ferrara (1991) and Kwon, & Taiti, S., (1993) regarded many species in Japan as a single species and they are junior synonyms of *Burmoniscus okinawaensis* (Nunomura, 1986). But, the present specimens more strictly closely agrees with the description of *japonicus* than that of *okinawaensis*.



**Fig. 2** *Burmoniscus japonicus* (Nunomura, 1986)

A, Outer lobe of maxillula; B, Pereopod 1; C, Pereopod 7; D, Penes and endopod of male first pleopod; E, Exopod of the same (All, Male from Kusatsu).

Family Oniscidae

***Exalloniscus cortii* Arcantgelli, 1927**

(Okamae-warajimushi)

*Material examined*: 1 ♀, Oroshimo, Kusatsu-shi, Oct. 5, 2009, coll. Noboru Nunomura.

Family Agnaridae

***Mongoloniscus oumiensis* n.sp.**

(Japanese name: Oumi-sato-warajimushi, new)

(Fig.3-4)

*Material examined*: 2 ♂♂ (1 ♂ holotype, 8.5 mm in body length and 1 ♂ paratype, 7.4mm in body length) and 29 ♀♀ (1 ♀ allotype, 10.5 mm in body length and 28 ♀♀ paratypes, 6.9-10.2 mm in body length), Kouzubata, Higashi-oumi-shi, Shiga, Pref. 5 July, 2009, coll. Noboru Nunomura. Type series is deposited as follows: holotype (TOYA Cr-19854), allotype (TOYA Cr-19855) and 9 paratypes (TOYA Cr-19856~19864) at Toyama Science Museum, 5 paratypes (LBM 1430004925) at Biwako Museum, 5 paratypes (OMNH Ar-7761~7765) at Osaka Museum of Natural History, 5 paratypes (KMNH IvR 500, 468~500, 472) at Kitakyushu Museum of Natural History and Human History, and 5 paratypes (NSMT Cr-20961) at National Museum of Nature and Science, Tokyo.

*Other specimens*: 2 ♀♀, Odagahama, Okisima-sho, Oumihachiman-shi, 5. Oct. 2009, coll Noboru Nunomura; 1 ♀, Oroshimo, Kusatsu-shi, 5. Oct. 2009, coll. Noboru Nunomura; 1 ♀, Ikishiro-jinja, Kusatsu-shi, coll. 11, Aug. 2009, Hidebumi Sato.

*Description:* Body (Fig.3A) ellipsoid, 2. 1 times as long as wide. Color blackish, with many irregular paler patterns. Anterior margin of cephalon (Fig.1B) raised flatly. Noduli lateralis on pereonal somites 2-4(Fig.1Q) remote from

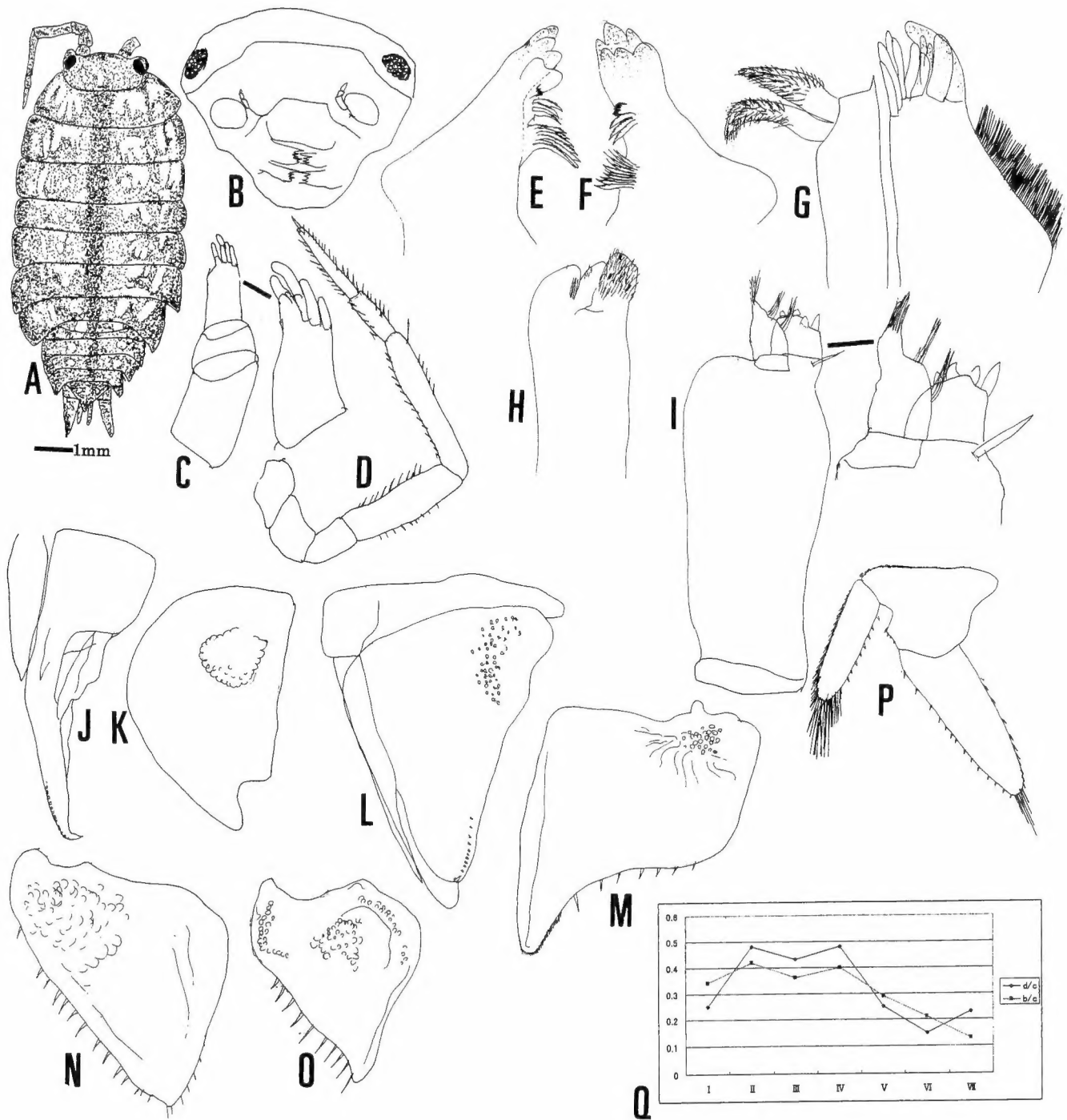


Fig. 3 *Mongoloniscus oumiensis* n.sp.

A, Dorsal view; B, Frontal view of cephalon; C, Antennule; D, Antenna; E, Right mandible; F, Left mandible; G, Maxillula; H, Maxilla; I, Maxilliped; J, Penes and endopod of the male first pleopod; K, Exopod of the same; L, Male second pleopod; M-O, Exopod of male pleopods 3-5; P, Uropod; Q, Position of noduli lateralis (All, Holotype male).



lateral border. Eyes, each eye with 30 ommatidia. Posterior margin of pleotelson triangular.

Antennule (Fig.3C) 3-segmented; terminal segment with 5-6 aesthetascs at the tip. Antenna (Fig.3D), reaching to the anterior part of second pereonal somite; mutual length of two flagellar segments 4:7.

Right mandible (Fig.3E): pars incisiva 3-headed; lacinia mobilis not chitinized and weakly 2-headed; 3 penicils between lacinia mobilis and processus molaris; processus molaris represented by a tuft of setae. Left mandible (Fig. 3F); pars incisiva 3-headed; lacinia mobilis 3-headed; 3 penicils between lacinia mobilis and processus molaris; processus molaris represented by a tuft of setae. Maxillula (Fig.3G): inner lobe with 2 plumose setae and a small projection; outer lobe 10 simple setae on distal margin. Maxilla (Fig.3H) apically bilobed, and rather narrow. Maxilliped (Fig.3I): endite rounded, with 4 spurs; palp relatively short.

Pereopod 1 (Fig. 4A) :basis 3.5 times as long as wide, with 12 setae on inner margin; ischium 0.4 times as long as wide, with 11-12 setae on inner margin; merus as long as ischium, with many long setae on inner margin, and with 2-3 setae at outer distal area; carpus a little longer than merus, with 17-18 setae on inner margin, a strong seta at outer distal angle and more than 25 short setae on outer margin; propodus a little longer than carpus, with 14-15 shorter setae on basal half and 4 bifurcated ones on distal half of inner margin.

Pereopod 2 (Fig.4B): basis 3.3 times as long as wide, with 16-17 short setae on inner margin and 6-7 short setae on outer margin; ischium 0.4 times as long as basis, with 2 setae on basal half of inner margin and 2 setae at inner distal angle; merus a little shorter than ischium, with 8-10 setae on inner margin and a seta at outer distal angle; carpus 1.4 times longer than merus, with 10-12 setae on inner margin, 3 stronger teeth on distal margin and 10 short setae on outer margin; propodus 0.9 times as long as carpus, with 10 setae on inner, margin and 8-9 short setae on outer margin.

Pereopod 3 (Fig.4C): basis 3.0 times as long as wide, with 14-15 short setae on inner margin; ischium half the length of basis, with 5-6 setae on inner margin and a seta on outer margin; merus about 2/3 as long as ischium, with 4 relatively shorter setae on basal area and 4 longer ones on distal half of inner margin; carpus 1.5 times longer than merus, with 4 longer setae and more than 14 shorter setae on inner margin; propodus as long as carpus, with 4 longer and 6 shorter setae on inner margin and 9-10 setae on outer margin.

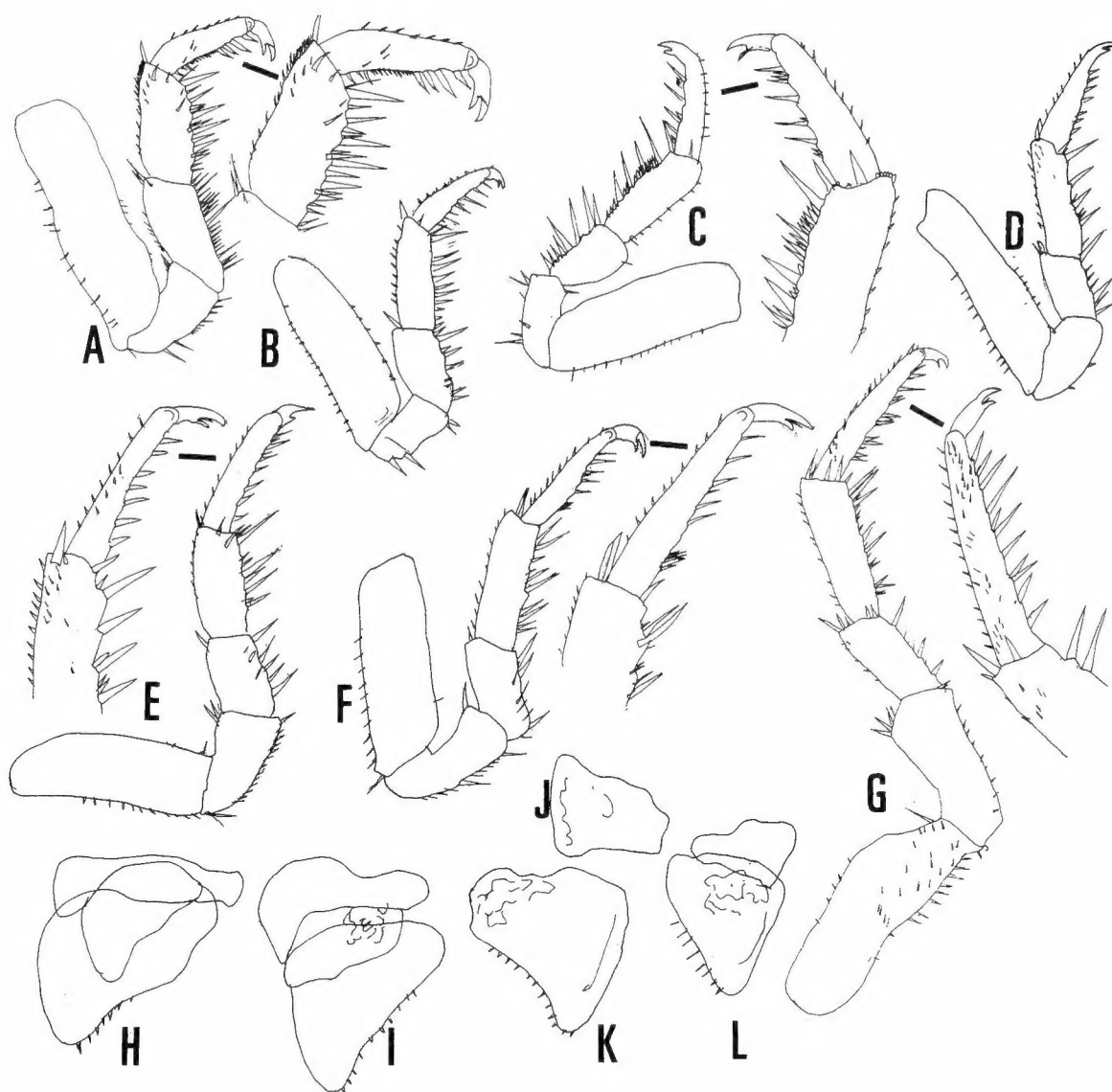
Pereopod 4 (Fig.4D): basis 3.6 times as long as wide, with 14 short setae on inner margin and 7-8 short setae on outer margin; ischium half the length of basis, with 2 setae on inner margin and a seta at outer margin; merus 2/3 as long as ischium, with 7 setae on inner margin and 2 setae on outer distal angle; carpus 1.7 times longer than merus, with 5-6 longer setae and 4-5 shorter setae on inner margin, and 8-10 short setae on outer margin; propodus a little shorter than carpus, with 7 setae on inner margin, and 8-9 short setae on outer margin.

Pereopod 5 (Fig.4E): basis 3.0 times, with 11-12 setae on inner margin; ischium 0.7 times as long as basis, with more than 16 setae on inner margin and 2 setae at outer distal angle; merus 0.7 times as long as ischium, with 5 setae on inner margin and a seta at outer distal angle; carpus 1.4 times longer than merus, with 4 longer and 5-6 shorter setae on inner margin, 4 setae on distal area and 10 short setae on outer margin; propodus 1.3 times longer than carpus, with 11-12 setae on inner margin and 6-7 short setae on outer margin.

Pereopod 6 (Fig.4F): basis 3.0 times as long as wide, with 11 setae on inner margin; ischium 65% as long as basis, with 11-12 setae including 2 longer ones on inner margin and a seta at outer distal angle; merus 0.7 times as long as ischium, with 4-5 setae on inner margin and a seta at outer distal angle; carpus 1.6 times longer than merus, with 10-13 setae on inner margin and 2 setae at outer distal angle; propodus as long as carpus, with 11-12 setae on inner margin and 10 short setae on outer margin.

Pereopod 7 (Fig.4G): basis 3.2 times as long as wide; ischium 0.6 times as long as basis, with 7-8 setae on inner margin and a seta at outer distal angle; merus 0.6 times as long as ischium, with 9-10 setae on inner margin and a seta at outer distal angle; carpus 1.4 times longer than merus, with 17-18 setae on inner margin, 6-7 setae on distal margin and 11 -12 setae on outer margin; propodus with 3 stronger teeth on basal area and 4 stronger setae on distal area and about 11-12 shorter setae on middle area of inner margin.

Penes (Fig.3J) fusiform. Pleopod 1(Fig.3 J&K): endopod tapering towards the tip but apical area bent outwards,



**Fig.4** *Mongoloniscus oumiensis* n.sp.

A-G, pereopods 1-7; H-I, Female pleopods 1-2 ; J, Endopod of female pleopod 3; K, Exopod of the same; L Female pleopod 5,(A-G, Holotype male; H-L, Female paratypes).

bearing a series of more than 15 denticles; exopod semicircular, with a shallow concavity.

Pleopod 2 (Fig.3L): endopod relatively short, not reaching the tip of exopod; exopod elongated triangular, with 10 denticles on distal area of outer margin.

Pleopod 3 (Fig.3M): exopod with 7 denticles on outer margin.

Pleopod 4 (Fig.3N): exopod triangular, with 20-24 denticles around the margin.

Pleopod 5 (Fig.3O): exopod triangular with 7-8 denticles on outer margin.

Uropod (Fig.3P): exopod 3/4 as long as exopod, with many setae on distal margin.

*Female*: Roughly same as male except sexual character.

*Etymology*: "Oumi" is the old name of Shiga Prefecture.

*Remarks*: The present new species is most closely allied to *Mongoloniscus satsumaensis* recorded from Aira, Kagoshima, southern Kyushu (Nunomura, 1987), but the former is separated from the latter in the following features:(1)remoter position of pereonal somites 2-4, (2)lack of bifurcated teeth on maxillula, (3)shorter endopod of male



second pleopod and (4) pointed apex of penes.

The present new species is separated from the commonest species of the genus *Mongoloniscus* in middle Japan in the following features : (1) shorter and rounder antero-lateral lappets of cephalon, (2) more setae on pereopods, (3) relatively short terminal flagellar segment of antenna, (4) more aesthetascs of antennule and (5) relatively remote position of noduli lateralis on pereonal somites 2-4.

The present new species is also to *M. nipponicus*, but the former is separated from the latter in the following features : (1) shallower concavity of expod of male pleopod 1, (2) shorter endpod of male pleopod 2, (3) sparser setae on pereopods 1-2 and (4) remoter position of nodule lateralis on pereonal somites 2-4.

***Mongoloniscus nipponicus* Arcangeli, 1927**

(Japanese name : Yamato-satowarajimushi)

*Specimens at TSM*: 6 ♀♀ (TOYA Cr-6833~6838), Shiga-cho, May 30, 1978, coll. Hiroyuki Watanabe.

*Remarks*: As no male specimens are available, I could not identify further.

***Agnara biwakoensis* n.sp.**

(Japanese name: Kokoku-hina-warajimushi, new)

(Fig.5-6)

*Material examined*: 12 ♂♂ (1 ♂ holotype, 3.5 mm in body length and 11 ♂♂ paratypes, 2.8-3.5 mm in body length) and 31 ♀♀ (1 ♀ allotype, 4.5 mm in body length and 30 ♀♀ paratypes, 3.2-4.5 mm in body length), Beach of Imazu-jhama, Kitoge, Takashima-shi, Shiga Pref. Oct, 4 2009 coll. Noboru Nunomura. Type series is deposited as follows: holotype (TOYA Cr-19871), allotype (TOYA Cr-19872) and 9 paratypes (TOYA Cr-19873~19881) at Toyama Science Museum, 8 paratypes (LBM1430004926) at Biwako Museum, 8 paratypes (OMNH Ar-7766~7773) at Osaka Museum of Natural History, 8 paratypes (KMNH IVR ~500,473-500, 480) at Kitakyushu Museum of Natural History and Human History, and 8 paratypes (NSMT Cr- 20960) at National Museum of nature and Science, Tokyo.

*Other specimens*: 1 ♂, Kawachi, Taga-cho, 11. Aug. 2009, coll. Hidebumi Sato.

*Description of male*: Body (Fig.1A) ellipsoid, 2.3 times as long as wide. Color paler brown, with many irregular patterns. Anterior margin of cephalon with both rami of antero-lateral angles of cephalon only slightly protruded. Eyes relatively big, each eye with 13 ommatidia. Noduli lateralis on pereonal somites 3-5 near lateral border (Fig. 5R). Posterior margin of pleotelson triangular.

Antennule (Fig.5C): terminal segment with 4 aesthetascs at the tip. Antenna (Fig 5D), reaching the posterior end of first pereonal somite; flagellum 2-segmented and a little shorter than the fifth peduncular segment; distal flagellar segment 3.1 times longer than basal one.

Right mandible (Fig. 5E): pars incisiva 4-headed; lacinia mobilis not chitinized and only slightly 2-headed; 2 penicils between lacinia mobilis and processus molaris; processus molaris represented by a tuft of setae. Left mandible (Fig. 5F): pars incisiva 4-headed; lacinia mobilis 3-headed; 2 penicils between lacinia mobilis and processus molaris; processus molaris represented by a tuft of setae. Maxillula (Fig 5G): inner lobe slender with 2 plumose setae on inner half of distal margin and a small acute projection on outer distal end; outer lobe with 9 relatively stout simple teeth and a serrate one. Maxilla (Fig. 5H) apically bilobed, the inner wider and bearing a field of densely spaced sensilla. Maxilliped (Fig. 5I): endite with 4 spurs on distal margin and a seta at the distal area; palp relatively slender, with a strong seta on basal segment.

Pereopod 1 (Fig. 6A): basis 2.4 times as long as wide, with a seta at inner distal angle; ischium 0.6 times as long as basis, with 7-8 setae on inner margin and 2 setae on outer margin; merus with 6-7 setae on inner margin; carpus with more than 20 setae on inner margin; propodus a little longer than carpus, with a series of 15-16 short setae on basal half of inner margin and 2 relatively long setae on distal half of inner margin.

Pereopod 2 (Fig. 6B): basis 2.8 times as long as wide, with 6-7 setae on inner margin; ischium half the length of basis, with 7-8 setae on inner margin; merus almost as long as ischium, with 7-8 setae on inner margin and a seta

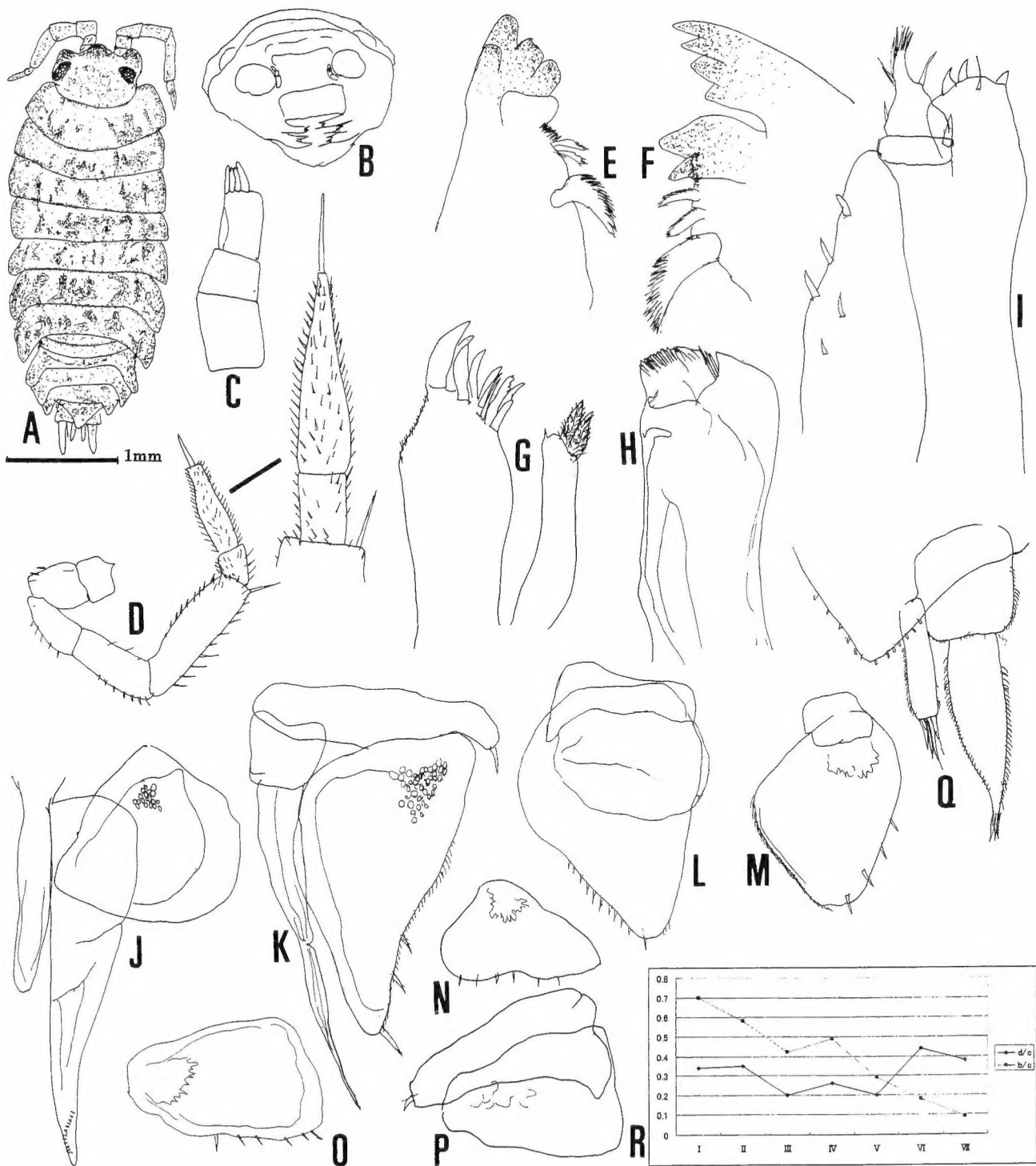
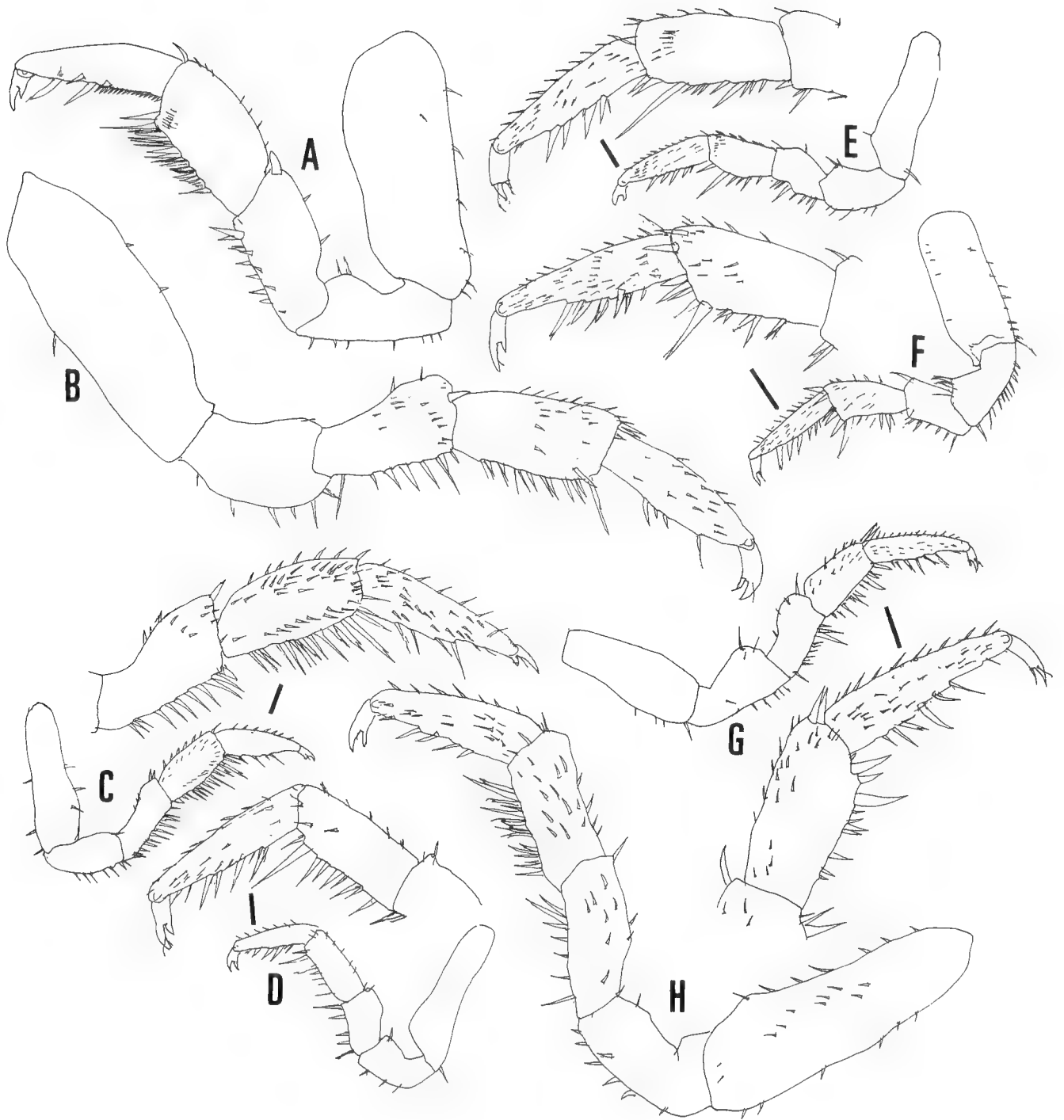


Fig. 5 *Agnara biwakoensis* n.sp.

A, Dorsal view; B, Frontal view of cephalon; C, Antennule; D, Antenna; E, Right mandible; F, Left mandible; G, Maxillula; H, Maxilla; I, Maxilliped; J, Penes and first pleopod; K, Pleopod 2 of male; L, Pleopod 3 of male; M, Exopod of pleopod 4 of male; N, Exopod of pleopod 5 of male; O: Pleopod 1 of female; P Pleopod 2 of female. Q, Uropod, R Position of noduli lateralis (A-N, Q-R: Holotype male O-P: Female paratype).



**Fig. 6** *Agnara biwakoensis* n.sp.

A-G, Pereopods 1-7 of male; H, Pereopod 7 of female (A-G, Holotype male; H, Allotype female).

at outer distal angle; carpus a little longer than merus, with 12-13 setae on inner margin; propodus 1.1 times longer than carpus, with 4 setae on inner margin.

Pereopod 3 (Fig.6C): basis 3.2 times as long as wide, with 3-4 setae on both margins; ischium  $\frac{3}{5}$  as long as basis, with 7-9 setae on inner margin; merus a little shorter than ischium, with 10 setae on inner margin and 2 setae on outer distal angle; carpus a little longer than merus, with 15-17 setae including some bifurcated ones on inner margin and 7-8 setae on outer margin; propodus slightly longer than carpus, with 4 longer and 2-3 shorter setae on inner margin and 6-8 setae on outer margin.

Pereopod 4 (Fig.6D): basis 3.5 times as long as wide, with a seta at inner distal angle; ischium half the length of basis, with 3 setae on inner margin and a seta at outer distal angle; merus 65% as long as ischium, with 5-6 setae on inner margin and 2-3 setae on outer distal area; carpus 1.4 times longer than merus, with 8-10 setae on inner margin and 5-6 setae on outer margin; propodus 1.1 times longer than carpus, with 4 stronger and 4-5 weaker setae on inner margin and 9-10 setae on outer margin.

Pereopod 5 (Fig.6E): basis 3.3 times as long as wide, with a seta at inner distal angle; ischium 0.6 times as long as basis, with 5-6 setae on inner margin and 2 setae at outer distal angle; merus  $\frac{2}{3}$  as long as ischium, with 8 setae on inner margin; carpus 1.4 times longer than merus, with 11-12 setae including a long one on inner margin; propodus 1.2 times longer than carpus, with 4 stronger and 4-5 weaker setae on inner margin and 10-12 setae on outer margin.

Pereopod 6 (Fig.6F): basis 4 times as long as wide, with 7-8 setae on inner margin and a seta at inner distal angle; ischium 0.6 times as long as basis, with 11-12 setae on inner margin and 4-5 setae on outer distal area; merus  $\frac{2}{3}$  as long as ischium, with 6-8 setae on inner margin and a seta at outer distal margin; carpus 1.1 times longer than merus, with 6-7 setae on inner margin, 6 setae on distal margin; propodus 1.2 times longer than carpus, with 7-8 setae including a bifurcated one and 10-12 setae on outer margin.

Pereopod 7 (Fig.6G): basis 2.4 times as long as wide, with a seta at inner distal angle; ischium  $\frac{2}{3}$  as long as basis, with 5-6 setae on inner margin and 2-3 setae on sternal margin; merus 0.7 times as long as wide, with 10 setae including 2 stronger ones on inner margin; carpus as long as merus, with 11-12 setae on inner margin and 2 stronger teeth at outer distal angle and 7-8 short setae on outer margin; propodus 1.2 times longer than carpus, with 6-7 setae including a bifurcated one on inner margin and 11-12 setae on outer margin.

Penes (F. 5J) 6 times as long as wide, with rounded apical tip.

Pleopod 1 (Fig.5J): endopod with a series of more than 12 denticles on apical area; exopod semicircular.

Pleopod 2 (Fig. 5K): basis short, with a seta on outer margin; endopod beyond 24% longer than exopod; exopod triangular, with 3 setae on distal margin.

Pleopod 3 (Fig. 5L): endopod rectangular; exopod triangular, with 10-11 setae.

Pleopod 4 (Fig. 5M): exopod rounded triangular, with 4 setae.

Pleopod 5 (Fig. 5N): exopod triangular, with 6 setae.

Uropod (Fig.5Q): basis rectangular; endopod  $\frac{3}{5}$  as long as exopod; exopod a little longer than endopod.

*Female*: Roughly same to male except sexual characters and slightly less numerous setae on pereopods (Fig. 6H). Pleopod 1 and pleopod 2 are as Fig.5 O and P, respectively.

*Etymology*: "Biwako" is the name of the lake where the type locality is faced.

*Remarks*: The present new species is most closely allied to *Agnara pannosus* recorded from Hakui, Ishikawa Prefecture (Nunomura, 1987), but the former is separated from the latter in the following features: (1) not sinuate outer margin of exopod of male first pleopod, (2) more aesthetascs on antennule, (3) presence of serrated teeth on outer lobe of maxillula, (4) more setae on exopod of pleopod 2 and (5) presence of an acute projection on inner lobe of maxillula.

The present new species is also allied to *A. gotoensis* recorded from Fukue-jima, Goto Islands, Nagasaki Prefecture, western Japan, but the former is separated from the latter in the following features: (1) paler color patterns, (2) semicircular exopod of male first pleopod, (3) longer endopod of male second pleopod, (4) numerous setae on pereopods, (5) presence of serrated tooth on outer lobe of maxillula and (6) less numerous aesthetascs at the tip of

antennule.

***Lucasioides nishimurai* Nunomura, 1987**

(Japanese name: Satoyama-warajimushi)

(Fig.7-8)

*Material examined*: 1 ♂ 1 ♀, Yamanashi, Kinomoto-cho, Oct. 6, 2009, coll. Noboru Nunomura; 2 ♂♂ 1 ♀, Foot of Choumeiji-san, Choumeiji-cho, Omihachiman-shi, Oct.5, 2009, coll. Noboru Nunomura; 6 ♂♂ 2 ♀♀, Oroshimo, Kusatsu-shi, Oct. 5, 2009, coll. Noboru Nunomura.

*Redescription on specimens from Kinomoto*: Body ellipsoid (Fig.7A), 2.1 times as long as wide. Color blackish, with many irregular paler patterns. Anterior margin of cephalon (Fig. 7B) low triangular. Eyes mediocre in size and each eye with 20 ommatidia. Posterior margin of pleotelson triangular, with a shallow concavities on both margins.

Antennule (Fig.7C): terminal segment with 10-11 aesthetascs. Antenna (Fig.7D), reaching to the end of second pereonal somite; two flagellar segment is sub-equal in length. Right mandible (Fig.7E): pars incisiva 3-headed; lacinia mobilis not chitinized and slightly 2-headed; 2 penicils between lacinia mobilis and processus molaris; processus molaris represented by a tuft of setae. Left mandible (Fig.7F): pars incisiva 3-headed; lacinia mobilis 2-headed; 2 penicils between lacinia mobilis and processus molaris; processus molaris represented by a tuft of setae. Maxillula (Fig.7G): inner lobe with 2 plumose setae and an acute projection; outer lobe with 10 simple setae. Maxilla narrow, apically bilobed, the inner wider and bearing a field of densely spaced sensilla. Maxilliped (Fig.7H) endite rectangular, with 4 spurs on distal margin and a long seta; palp relatively short, first segment with a weak seta.

Pereopod 1 (Fig.8A): basis 2.0 times as long as wide; ischium 2/3 as long as basis; merus a little shorter than ischium, with many setae on inner margin; carpus 1.2 times longer than merus, with many setae including several bifurcated ones on inner margin; propodus with a series of 7-8 setae; 12 small setae on basal half and 3 bifurcated setae on distal area of inner margin.

Pereopod 2 (Fig.8B): basis 3.0 times as long as wide, with more than 21 short setae on inner margin and 12-13 setae on outer margin; ischium half the length of basis, with 12-13 setae on inner margin and 3 stronger setae on outer margin; merus a little longer than ischium, with many setae on inner margin, a seta on distal area and 9-10 setae on outer margin; carpus 1.2 times longer than merus, with many setae including several bifurcated setae on inner margins; propodus 0.85 times as long as carpus, with 7 setae on inner margin and more than 18 short setae on outer margin;

Pereopod 3 (Fig.8C): basis 3.7 times as long as wide, with 5 setae on inner margin; ischium half the length of basis, with 5 setae on inner margin and 2-4 setae on outer margin; merus 3/4 as long as ischium, with 7 setae on inner margin and 10 setae on outer margin; carpus 1.6 times longer than merus, with more than 30 setae on inner margin, 3-4 setae on distal area and 10 short setae on outer margin; propodus as long as carpus, with 6-7 setae on inner margin and 17-18 short setae on outer margin.

Pereopod 4 (Fig.8D): basis 3.4 times as long as wide, with a seta at inner distal angle; ischium 0.4 times, with 7 setae on inner margin and a seta on outer margin; merus a little longer than merus, with 6-7 setae including a bifurcated one on inner margin and a seta on outer margin; carpus 1.5 times longer than merus, with 15-17 setae on inner margin, 5-7 setae on distal margin and 14-15 setae on outer margin; propodus as long as carpus, with 7 stronger and 7-10 weaker setae on inner margin and more than 25 short setae on outer margin.

Pereopod 5 (Fig.8E): basis 3.0 times as long as wide, with 14-15 short setae on inner margin and a seta at inner distal angle; ischium 2/3 as long as basis, with 7-8 setae on inner margin and 2 setae on outer margin; merus half the length of ischium, with 5 setae on inner margin and 2 setae at outer distal angle; carpus 1.8 times longer than merus, with 3 longer and 5-6 shorter setae on inner margin, 3 setae on distal margin and more than 17 short setae on outer margin; propodus 1.1 times longer than carpus, with 10 setae including a bifurcated one on inner margin and 23-34 short setae on outer margin.

Pereopod 6 (Fig.8F): basis 3.1 times as long as wide; ischium 0.6 times as long as wide, with 8-13 short setae on both margins and 2 teeth at outer distal angle; merus half the length of ischium, with 2 setae at inner distal area,

5 stronger setae on distal margin; carpus 1.6 times longer than merus, with 5 long setae including a bifurcated ones and many short setae on inner margin; propodus 1.2 times longer than carpus, with 8 longer and more than 16 shorter setae on inner margin and more than 33 short setae on outer margin.

Pereopod 7 (Fig.8G): basis 3.6 times as long as wide, with a seta at inner distal angle and 5-7 short setae on both margins; ischium  $\frac{2}{3}$  as long as basis, with 10-12 setae on inner margin and 3 setae on sternal margin; merus 0.7 times as long as ischium, with 8-10 longer and 10-12 short setae on inner margin and 4 relatively long setae on outer distal area, and 6-7 setae on outer margin; carpus 1.35 times longer than merus, with 7 longer and several shorter setae

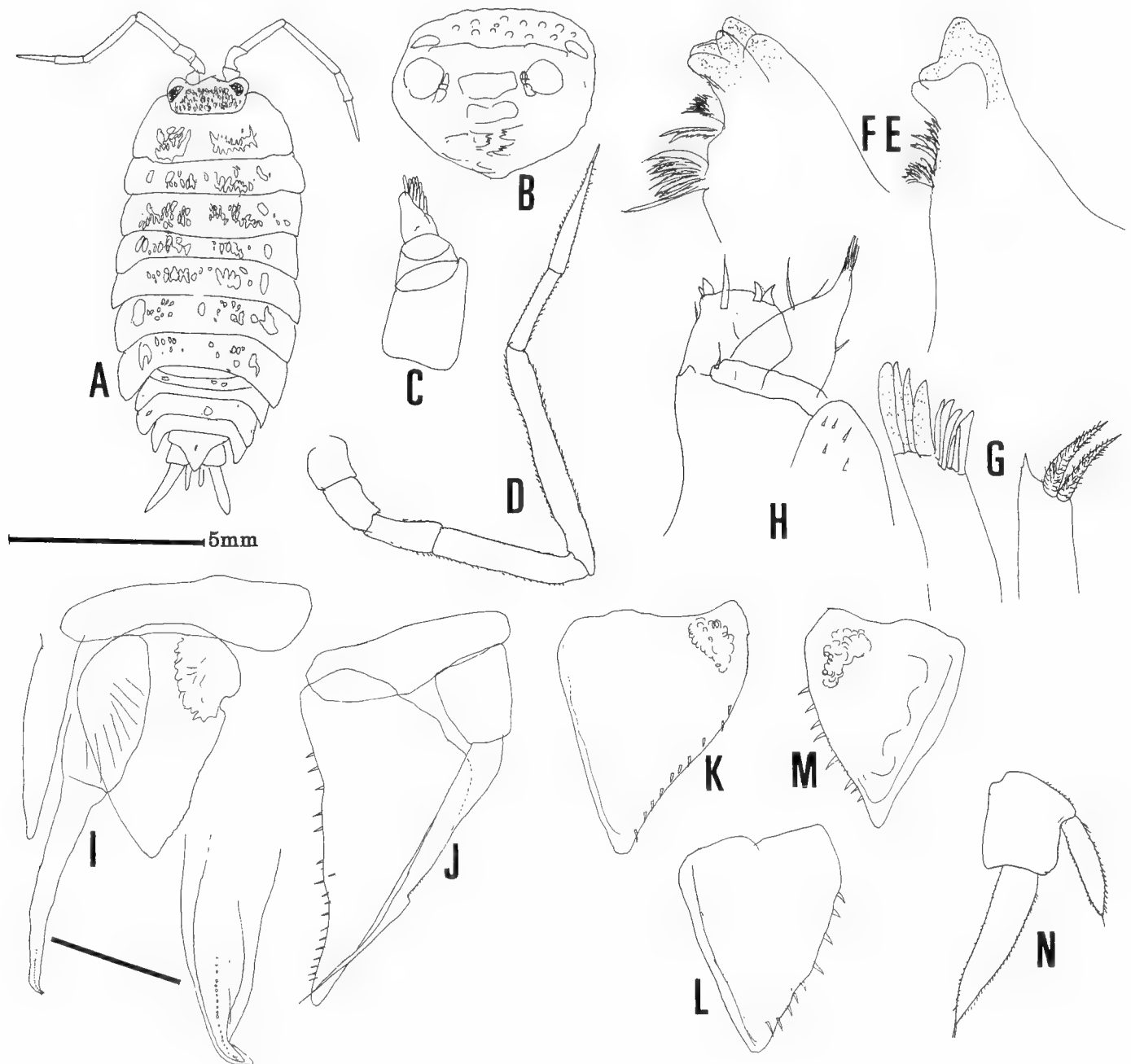


Fig. 7 *Lucasioides nishimurai* Nunomura, 1987

A, Dorsal view; B, Frontal view of cephalon; C, Antennule; D, Antenna; E, Right mandible; F, Left mandible; G, Maxillula; H, Maxilliped; I, Penes and male first pleopod; J, Male second pleopod; K, Pleopod 3; L, Pleopod 4; M, Pleopod 5; N, Uropod(All, Male specimen collectel from Shizugatake).



on inner margin; propodus 1.2 times longer than carpus, with 9 longer and 5-6 shorter setae on inner margin and more than 25 short setae on outer margin.

Penes (Fig. 7I) fusiform. Pleopod 1(Fig. 7I): basis rectangular; endopod straight but apical part bents outer wards with a series of more than 30 denticles on apical area; exopod lanceolate, with a small concavity on basal half of outer margin.

Pleopod 2(Fig.7J): endopod slender a little exceeds beyond the tip of exopod; exopod elongated triangular, with 18 setae on outer margin.

Pleopod 3 (Fig.7K): endopod rectangular; exopod triangular, with 12 denticles on outer margin.

Pleopod 4 (Fig.7L): exopod triangular, with 10 denticles on outer margin.

Pleopod 5 (Fig.7M): a little smaller than pleopod 4; endopod rectangular; exopod triangular, with 5 denticles on outer margin.

Uropod (Fig. 7N): basis almost square; endopod rectangular and as long as basis; exopod 1.7 times longer than endopod.

*Remarks:* This species was described as *Nagurus nishimurai* (Nunomura,1987), and then moved to the genus *Lucasioides*. The record of Kinomoto, Shiga Prefecture is the north-most record of this species. The specimens agree with original description based on the specimens from Wakayama. But the following differences are observed: (1) shorter endopod of male pleopod 2, (2) presence of bifurcated setae, (3) numerous aesthetascs on antennule, (4) numerous denticles on apical part of male pleopod 1 and (5) narrower maxilla.

#### Family Armadillidae

##### *Spherillo dorsalis* (Iwamoto,1943)

(Japanese name: Seguro-koshibiro-dangomushi)

*Material examined:* 2♀♀, Kitanamami, Imazumachi, Takasima-shi, Oct. 4, 2009, coll. Noboru Nunomura; 1♀♀ Kizu-osaiki, Takashima-shi, July 4, 2009, coll. Noboru Nunomura; 1♀, Kawanami, Yogo-cho, July 4, 2009, coll. Noboru Nunomura; 1♀, Shore of Yogo-Ko, Kinomoto-cho, July 4, 2009, coll. Noboru Nunomura; 5sexs, Kawachi wind-vent, Kawachi, Taga-cho, July 5, 2009, coll. Noboru; 1♂4♀♀, Hayazaki-cho, "Okubiwa sports no mori" Oct. 2009, coll. Noboru Nunomura; 4♀♀, Kozubata, Eigenji, Higashi-oumi-shi, July 5, 2009, coll. Noboru Nunomura; 2♂♂8♀♀, Kawachi wind-vent, Kawachi, Taga-cho, July 5, 2009, coll. Noboru Nunomura and Yoshinari Enami; 2♂♂10♀♀ Kawachi wind-vent, Kawachi, Taga-cho, Aug. 1, 2009, Hidebumi Sato; 3♂♂7♀♀, *Quercus glauca* and *Camellia japonica* forest, Ikishiro-jinja, Kataoka-machi, Kusatsu-shi, Aug. 1, 2009, Hidebumi Sato; 2♀♀, Katorigo-jinja, Nishiazai-machi, Aug. 1, 2009, Hidebumi Sato; 4♂♂6♀♀, Kozubata, Eigenji, Higashi-oumi-shi, Aug. 2, 2009, Hidebumi Sato; 1♂4♀♀, *Cryptomeria* forest, Tagi-jinja, Maeno, Tsuchiyama-machi, Kouka-shi, July 5, 2009, coll. Noboru Nunomura; 4♂♂28♀♀, laurel forest, Tagi-jinja, Maeno, Tsuchiyama-machi, Kouka-shi, July 5, 2009, coll. Noboru Nunomura and Yoshinari Enami; 2♂♂6♀♀, Foot of Mt. Kojin-san, Mitsuya-cho, Hikone-shi, Oct. 5, 2009, coll. Noboru Nunomura; 1♂4♀♀, Foot of Azuchi-yama, Shimotoyura, Azuchi-cho, Oct. 5, 2009, coll. Noboru Nunomura; 2♀♀, Foot of Houmeiji-san, Choumeiji-cho, Oumihachiman-shi, Oct. 5, 2009, coll. Noboru Nunomura; 4♀♀, Foot of Kasahoko-yama, Odagahama, Okishima-cho, Oumihachiman-shi, Oct. 5, 2009, coll. Noboru Nunomura; 1♀, Oroshimo, Kusatsu-shi, Oct.5, 2009, coll. Noboru Nunomura; 1♂, Indani, Kitahira, Otsu-shi, Oct.5, 2009, coll. Noboru Nunomura.

*Specimens at TSM:* 1♂9♀♀ (TOYA Cr-18638~18647) Kidoguchi, Otsu-shi, July 4 1976, coll. Yoshiaki Nishikawa; 4♂♂6♀♀ (TOYA Cr-18600~18609) Kitahira, Shiga-cho, 115m, May 4, 1980, coll. Yoshiaki Nishikawa; 5♂♂6♀♀ (18612~18622) Juge-jinja, Minami-hira, Shiga-machi, 115m, coll. Yoshiaki Nishikawa, May 4, 1980; 7♂♂6♀♀ (TOYA Cr-18657), Samegaidani, Maihara-cho, 200m, coll. Shuhei Nomura, June 5, 1997.

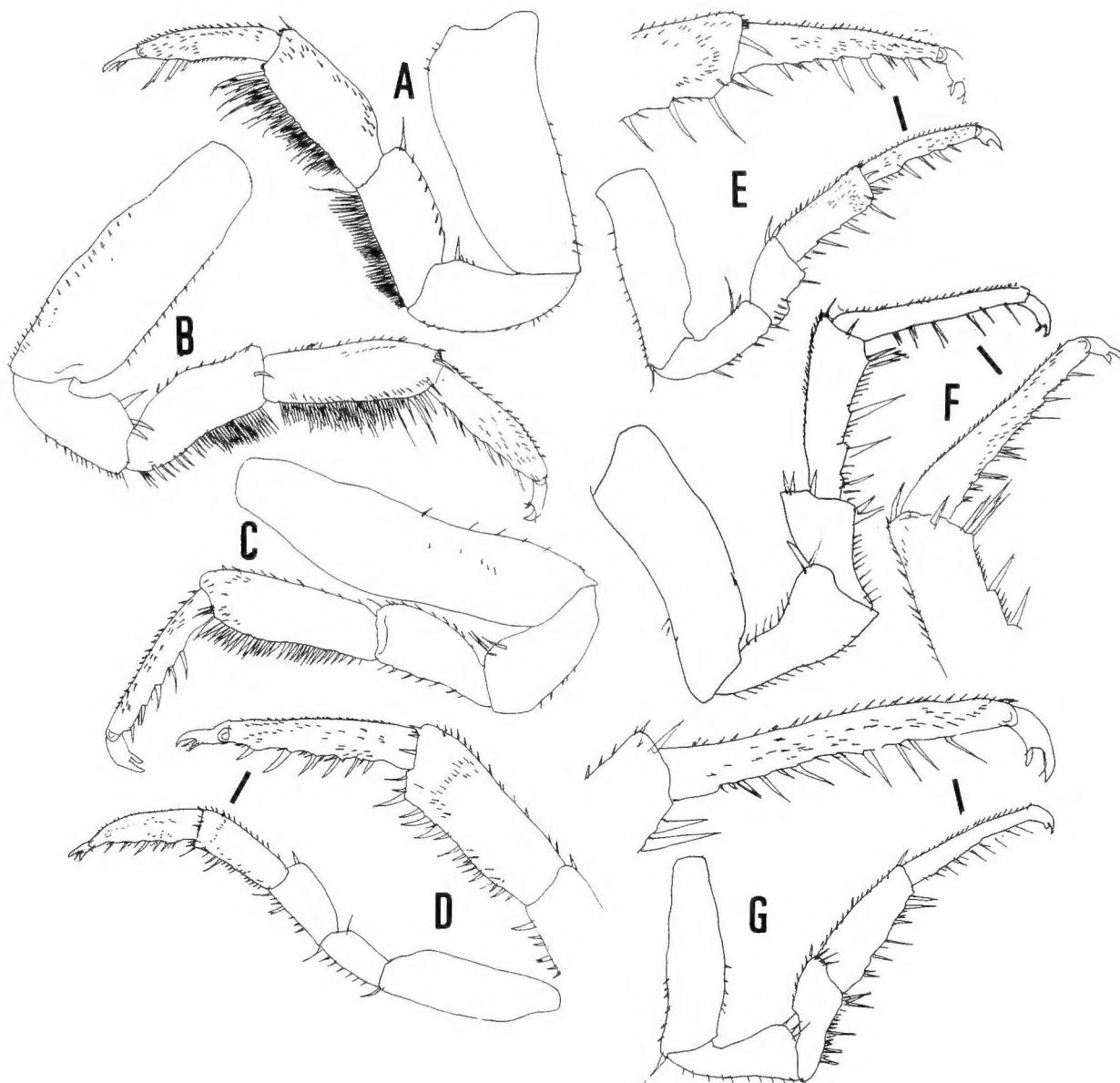


Fig. 8 *Lucasioides nishimurai* Nunomura, 1987

A-G, Pereopods 1-7 (All, male specimen collected from Shizugatake).

Family Porcellionidae

***Porcellio scaber* Latreille, 1804**

(Japanese name: Warajimushi)

*Material examined:* 2 ♀♀, Odagahama, Okishima-cho, Omihachiman-shi, Oct. 5, 2009, coll. Noboru Nunomura; 3 ♂♂ 4 ♀♀, Hayazaki-cho, "Okubiwa sports no mori" Oct. 6, 2009, coll. Noboru Nunomura; 6 ♀♀, Foot of Kasahoko-yama, Odagahama, Okishima-cho, Omihachiman-shi, Oct. 5, 2009, coll. Noboru Nunomura.

***Porcellionides pruinosus* (Brandt, 1833)**

(Japanese name: Hoso-warajimushi )

*Material examined:* 2 ♀♀ Tagi-jinja, Maeno, Tsuchiyama-machi, Kouka-shi, July 5, 2009, coll. Hiroyuki Watanabe; 3 ♂♂ 7 ♀♀, Akanoi, Moriyama-shi, Oct. 5, 2009, coll. Noboru Nunomura.

*Specimen at TSM:* 1 ♀ (TOYA Cr-6367), Tsushima-jinja, Santo-machi, Dec. 13, 1975, coll. Yoshiaki Nishikawa.

Family Armadillidiidae

***Armadillidium vulgare* (Latreille, 1804)**

(Japanese name: Oka-dangomushi)

*Material examined:* 1♂3♀♀, Imazuhamma beach, Takashima-shi, July 4, 2009, coll. Noboru Nunomura; 5♂♂3♀♀, Imazuhamma, Imazumachi, Kitoge, Takasima-shi, Oct. 4, 2009, coll. Noboru Nunomura; 1♀, Kitanamami, Imazumachi, Takasima-shi, Oct. 4, 2009, coll. Noboru Nunomura; 1♀, Koaraji, Makino-machi, Takasima-shi, Oct. 4, 2009, coll. Noboru Nunomura; 2♀♀, Shore of Yogo-Ko, Kinomoto-cho, July 4, 2009, coll. Noboru Nunomura; 1♂10♀♀, Yamanashi, Kinomoto-cho, Oct. 6, 2009, coll. Noboru Nunomura; 2♂♂9♀♀, Kouzubata, Eigenji, Higashi-oumi shi, July 5, 2009, coll. Noboru Nunomura and Yoshinari Enami; 2♀♀ Nishihama, Makino, Takashima-shi, July 4, 2009, coll. Noboru Nunomura; 4♀♀ Kaizu-osaki, Takashima-shi, July 4, 2009, coll. Noboru Nunomura; 5♂♂1, ♀ Hayazaki-cho, "Okubiwa sports no mori" Oct. 6, 2009, coll. Noboru Nunomura; 2♂♂1♀, Toyo-koen, Ooshima-cho, Nagahama-shi, Oct. 6, 2009, coll. Noboru Nunomura; 1♂6♀♀, Foot of Mt. Kojin-san, Mituya-cho, Hikone-shi, Oct. 5, 2009, coll. Noboru Nunomura; 1♀, Kawachi wind-vent, Kawachi, Taga-cho, July 5, 2009, coll. Noboru Nunomura; 3♂♂7♀♀, *Quercus glauca* and *Camellia japonica* forest, Ikishiro-jinja, Kataoka-machi, Kusatsu-shi, Aug. 1, 2009, Hidebumi Sato; 3♂♂6♀♀, Tagi-jinja, Maeno, Tsuchiyama-machi, Kouka-shi, July 5, 2009, coll. Hiroyuki Watanabe; 1♂, *Cryptomeria* forest, Tagi-jinja, Maeno, Tsuchiyama-machi, Kouka-shi, July 5, 2009, coll. Noboru Nunomura; 5♂♂10♀♀, Foot of Choumeiji-san, Choumeiji-cho, Oumihachiman-shi, Oct. 5, 2009, coll. Noboru Nunomura; 1♂3♀♀, Akanoi, Moriyama-shi, Oct. 5, 2009, coll. Noboru Nunomura; 1♂18♀♀, Oroshimo, Kusatsu-shi, Oct. 5, 2009, coll. Noboru Nunomura; 4♀♀, Indani, Kitahira, Otsu-shi, Oct. 5, 2009, coll. Noboru Nunomura; 1♂7♀♀, Imakatata, Otsu-shi, Oct. 5, 2009, coll. Noboru Nunomura.

*Specimens at TSM:* 2exs, Shiga-madchi, Juge-jinja, Kitakomatsu, Shiga-machi, June 17, 1978, coll. Hiroyuki Watanabe; 1♂6♀♀, Kitahira, Shiga-cho, 115m, coll. Yoshiaki Nishikawa, May 4, 1980; 2♀♀ (TOYA Cr-18610~18611) Juge-jinnja, Minami-hira, Shiga-machi, 115m, coll. Yoshiaki Nishikawa, May 4, 1980; 1ex, Kashihara, Santo cho, Dec. 3. 1975, coll. Yoshiaki Nishikawa; 3exs, Kaminyu, Maihara-cho, June 17, 1978, coll. Yoshiaki Nishikawa.

Order Amphipoda

Family Taltridae

***Platorchestia humicola* (Martens, 1868).**

(Japanese name: Oka-tobimushi)

*Material examined:* 4exs, Kitanamami, Imazumachi, Takasima-shi, Oct. 4, 2009, coll. Noboru Nunomura; 7exs, Foot of Mt. Nishiyama, Kutsuki, Takasima-shi, Oct. 4, 2009, coll. Noboru Nunomura; 4exs, Nishihama, Makino, Takashima-shi, July 4, 2009, coll. Noboru Nunomura; 2exs, Kaizu-osaki, Takashima-shi, July 4, 2009, coll. Noboru Nunomura; 25exs, Kawanami, Yogo-cho, July 4, 2009, coll. Noboru Nunomura; 18exs, Kozubata, Eigenji, Higashi-oumi-shi, July 5, 2009, coll. Noboru Nunomura and Yoshinari Enami; 22exs, Kawachi wind-vent, Kawachi, Taga-cho, July 5, 2009, coll. Noboru Nunomura, Hiroyuki Watanabe and Yoshinari Enami; 8exs, *Cryptomeria* forest, Tagi-jinja, Maeno, Tsuchiyama-machi, Kouka-shi, July 5, 2009, coll. Noboru Nunomura; 20exs, laurel forest, Tagi-jinja, Maeno, Tsuchiyama-machi, Kouka-shi, July 5, 2009, coll. Noboru Nunomura and Yoshinari Enami; 2exs, Kouzubata, Eigenji, Higashi-oumi-shi, Aug. 2, 2009, Hidebumi Sato; 9exs, Indani, Kitahira, Otsu-shi, Oct. 5, 2009, coll. Noboru Nunomura; 8exs, Foot of Choumeiji-san, Choumeiji-cho, Oumihachiman-shi, Oct. 5, 2009, coll. Noboru Nunomura.

Order Decapoda

Family Potamididae

***Geothelphusa dehaani* (White, 1847)**

(Japanese name: Sawagani)

*Material examined:* 1ex, Kawachi wind-vent, Kawachi, Taga-cho, July 5, 2009.

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